

Patent Application  
Docket No. 27889-00037USPT

**IN THE CLAIMS**

Please amend the claims as follows.

1 <sup>Sub I</sup> 1. (currently amended) A cooling apparatus for removing heat from at least one heat  
2 generating component, said cooling apparatus comprising:  
3 a low profile metal unitary member comprised of one piece of metal, said low profile  
4 unitary member having a first exterior surface adapted for receiving heat from the at least one heat  
5 generating component and having a plurality of micro tubes formed of said one piece of metal having  
6 a flattened heat transfer surface, said low profile metal unitary member having a micro tube inlet  
7 comprised of said one piece of metal and a micro tube outlet comprised of said one piece of metal,  
8 said low profile metal unitary member providing an entirely metallic thermal path for conducting heat  
9 from said first exterior surface to a heat transfer fluid contained within said plurality of micro tubes,  
10 said plurality of micro tubes being formed along an axis relative to said low profile unitary member;  
11 <sup>18</sup> an inlet tube;  
12 <sup>28a</sup> an cavities inlet end cap interconnecting the micro tube inlets in fluid communication  
13 and connecting the micro tube inlets in fluid communication with said inlet tube;  
14 <sup>22</sup> an outlet tube;  
15 <sup>296</sup> an cavities outlet end cap interconnecting the micro tube outlets in fluid  
16 communication and connecting the micro tube outlet in fluid communication with said outlet tube;  
17 ~~said low profile metal unitary member being sealed by a first seal and a second seal~~  
18 ~~for enclosing said low profile metal unitary member, said first seal being formed at said inlet end cap,~~

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19 ~~inlet~~ said second seal being formed at said outlet end cap, said first seal forming a first seal length and said  
20 ~~inlet~~ second seal forming a second seal length;  
21 each of said plurality of microtubes being fluidly connected to adjacent and non-  
22 adjacent microtubes via said inlet end cap and said outlet end cap;  
23 <sup>pump (14)</sup> means for circulating said heat transfer fluid through said inlet tube, said inlet end cap, <sup>18</sup>  
24 the plurality of micro tubes of said low profile metal unitary member, said outlet end cap, and said  
25 outlet tube in a manner such that said fluid is injected into and ejected from said low profile unitary  
26 member parallel to said axis of said micro tubes; and  
27 means for removing heat from said heat transfer fluid.

1 2. (canceled)

1 3. (previously amended) The cooling apparatus of claim 2, wherein said member is in thermal  
2 contact with the at least one heat generating component, and said member is further in direct contact  
3 with said heat transfer fluid.

1 4. (previously amended) The cooling apparatus of claim 2, wherein said low profile metal  
2 member is plated on an exterior surface with a metal material.

1 5. (previously amended) The cooling apparatus of claim 1, further comprising at least one  
2 thermoelectric cooling unit disposed between the at least one heat generating component and said

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3 first exterior surface.

1 *Sub*  
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*ent* 6. (previously amended) The cooling apparatus of claim 1, wherein said low profile metal  
2 member further comprises a plurality of fins on a second exterior surface opposite said first exterior  
3 surface adapted for receiving heat.

1 7. (previously amended) The cooling apparatus of claim 1, wherein said low profile metal  
2 member further comprises a plurality of fins or grooves on an interior surface of each of said plurality  
3 of micro tubes.

1 8. (currently amended) A cooling apparatus for removing heat from at least one heat  
2 generating component, said cooling apparatus comprising:

3 a low profile unitary member having a flattened exterior extrusion surface adapted for  
4 receiving heat from the at least one heat generating component and a plurality of micro tubes with  
5 a micro tube inlet and a micro tube outlet, said plurality of micro tubes being formed along an axis  
6 relative to said low profile unitary member;

7 *Fig. 8 /* at least one fin on an interior surface of at least one of said plurality of micro tubes;

8 an inlet tube;

9 an cavited inlet end cap interconnecting the micro tube inlets in fluid communication

10 and connecting the micro tube inlets in fluid communication with said inlet tube;

11 an outlet tube;

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12 *Sub*  
13 *Cont* a cavitated outlet end cap interconnecting the micro tube outlets in fluid communication  
14 and connecting the micro tube outlet in fluid communication with said outlet tube;

15 means for circulating a heat transfer fluid through said plurality of micro tubes of said  
16 low profile member in a manner such that said fluid is injected into said low profile unitary member  
17 and ejected from said member parallel to the axis of said micro tubes; and

means for removing heat from said heat transfer fluid.

1 9. (original) The cooling apparatus of claim 8, wherein each of said micro tubes are  
2 substantially rectangular in shape.

1 10. (previously amended) The cooling apparatus of claim 8, wherein said low profile member  
2 is formed of a metal material.

1 11. (previously amended) The cooling apparatus of claim 10, wherein said metal material is  
2 in thermal contact with the at least one heat generating component, and said metal material is further  
3 in direct contact with said heat transfer fluid.

1 12. (previously amended) The cooling apparatus of claim 8, further comprising at least one  
2 thermoelectric cooling unit disposed between the at least one heat generating component and said  
3 first exterior extrusion surface.

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1 13. (previously amended) The cooling apparatus of claim 8, wherein said low profile  
2 extrusion further comprises at least one fin on an interior surface of each of said plurality of micro  
3 tubes.

1 14.-20. (canceled)

1 21. (currently amended) A cooling apparatus for removing heat from at least one heat  
2 generating component, said cooling apparatus comprising:

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3 a low profile metal unitary member comprised of one piece of metal having a first  
4 exterior extrusion surface adapted for receiving heat from the at least one heat generating component  
5 and a plurality of micro tubes with a micro tube inlet comprised of said one piece of metal and a micro  
6 tube outlet comprised of said one piece of metal, said plurality of micro tubes being formed along an  
7 axis relative to said low profile unitary member, said low profile metal unitary member providing an  
8 entirely metallic thermal path for conducting heat from said first exterior extrusion surface to a heat  
9 transfer fluid contained within said plurality of micro tubes, said member having a profile of less than  
10 approximately 0.1 inches;

11 an cavities inlet end cap interconnecting the micro tube inlets in fluid communication;

12 an cavities outlet end cap interconnecting the micro tube outlets in fluid  
13 communication;

14 ~~\_\_\_\_\_ said low profile metal unitary member being sealed by a first seal and a second seal~~  
15 ~~for enclosing said low profile metal unitary member, said first seal being formed at said inlet end cap,~~

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16 ~~sub~~ ~~1~~ ~~out~~ said second seal being formed at said outlet end cap, said first seal forming a first seal length and said  
17 second seal forming a second seal length;

18 each of said plurality of micro tubes being fluidly connected to adjacent and non-  
19 adjacent micro tubes via said inlet end cap and said outlet end cap;

20 means for circulating said heat transfer fluid through said inlet end cap, the plurality  
21 of micro tubes of said low profile extrusion and said outlet end cap in a manner such that said fluid  
22 is injected into said low profile unitary member and ejected from said member parallel to the axis of  
23 said micro tubes; and

24 means for removing heat from said heat transfer fluid.

1 22. (previously amended) The cooling apparatus according to claim 21 wherein:

2 said cooling apparatus is affixed to a printed circuit board for cooling the heat  
3 generating component.

1 23. (previously amended) The cooling apparatus according to claim 1 wherein:

2 said cooling apparatus is affixed to a printed circuit board for cooling the heat  
3 generating component.

1 24. (previously amended) The cooling apparatus according to claim 8 wherein:

2 said cooling apparatus is affixed to a printed circuit board for cooling the heat  
3 generating component.

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1 25. (original) The cooling apparatus according to claim 1, wherein each of said micro tubes  
2 are polygonal in cross section.

1 26. (original) The cooling apparatus according to claim 1, wherein each of said micro tubes  
2 are substantially square in cross section.

1 27. (original) The cooling apparatus according to claim 8, wherein said micro tubes are  
2 polygonal in cross section.

1 28. (original) The cooling apparatus according to claim 8, wherein said micro tubes are  
2 substantially square in cross section.

1 29. (original) The cooling apparatus according to claim 21, wherein said micro tubes are  
2 polygonal in cross section.

1 30. (original) The cooling apparatus according to claim 1, wherein said micro tubes are  
2 substantially square in cross section.

1 31. (original) The cooling apparatus according to claim 21, wherein said micro tubes are  
2 substantially square in cross section.

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1 32. (original) The cooling apparatus according to claim 1 wherein:  
2 said member has a profile of approximately 0.1 inches.

1 33. (original) The cooling apparatus according to claim 8 wherein:  
2 said member has a profile of approximately 0.05 inches.

1 34. (original) The cooling apparatus according to claim 1, wherein said micro tubes have a  
2 diameter of between approximately .0625 inches and 0.5 inches.

1 35. (original) The cooling apparatus according to claim 8, wherein said micro tubes have a  
2 diameter of between approximately .0625 inches and 0.5 inches.

1 36. (original) The cooling apparatus according to claim 21, wherein said micro tubes have  
2 a diameter of between approximately .0625 inches and 0.5 inches.

1 37. (original) The cooling apparatus according to claim 21, wherein said low profile is  
2 approximately 0.05 inches.

1 38. (original) The cooling apparatus according to claim 21 further comprising:  
2 at least one fin on an interior surface of each of said plurality of micro tubes.



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No new matter has been added.